

This application is a continuation of U.S. Patent Application No. 09/638,208, filed August 11, 2000, by Jean-Pierre Lalonde, et al., entitled COOLING SYSTEM, now allowed, which application claims priority from and is a continuation-in-part of Application No. 09/489,646, filed January 24, 2000, by Jean-Pierre Lalonde, et al., entitled CLOSED LOOP CATHETER SYSTEM, now issued Patent No. 6,383,180, issued May 07, 2002, which claims priority from Provisional Application No. 60/117,175, filed January 25, 1999, by Marwan Abboud, et al., entitled CRYOABLATION SYSTEM, now expired, all of which are incorporated herein by reference.

IN THE CLAIMS

Claims 1-16. (Cancelled).

Claim 17. (Currently Amended) A ~~eryogenic~~ medical cooling system comprising:
a medical device;
a console ~~including accessories,~~ the connectable to the medical device at a connection point, the console controlling the temperature of the medical device, and the console including
a first system directing coolant in a mixed gas and liquid state to the medical device along a coolant supply line; and
a second system decreasing the percentage of gas in the coolant before the coolant reaches the connection point by controlling a temperature of the coolant.

Claim 18. (Currently Amended) The cooling system of claim 17, wherein the second system decreases the percentage of gas in the coolant by reducing the temperature of the coolant, and wherein the system further comprises
an chamber having an inlet and an outlet, wherein the enclosure defines a fluid path from the inlet to the outlet, and the enclosure envelops a portion of the coolant supply line; and
a controller for controlling coolant flow into the chamber.

Claim 19. (Currently Amended) The cooling system of claim 18, wherein the controller establishes a duty cycle for cyclically allowing and denying entry of coolant into the chamber at a rate responsive to a sensed temperature within the chamber to selectively raise, lower, and maintain the temperature of coolant within the coolant supply line.

Claim 20. (New) A medical cooling system for affecting the temperature of a treatment site, comprising:

- a medical device;
- a coolant supply;
- a first coolant flow path between the medical device and the coolant supply;
- a subcooler disposed about the portion of the first coolant flow path and having an inlet and an outlet;
- a second coolant flow path between the coolant supply and the inlet;
- a programmable controller coupled to a temperature sensor in the subcooler, the programmable controller controlling the flow of coolant through the first and second flow paths to regulate the temperature of the treatment site.

Claim 21. (New) The cooling system of claim 20, further comprising:

- a first valve in the first coolant flow path,
- a second valve in the second coolant flow path,
- wherein the programmable controller is coupled to the first and second valves.

Claim 22. (New) The cooling system of claim 21,

wherein the programmable controller establishes a duty cycle that opens and closes the second valve over time.

Claim 23. (New) The cooling system of claim 21,

wherein the subcooler includes a chamber enclosing the portion of the first coolant flow path and the chamber defines a third coolant flow path between the inlet and the outlet.

Claim 24. (New) The cooling system of claim 21,
wherein the subcooler includes a Peltier cooler.

Claim 25. (New) A medical cooling system comprising:
a coolant supply unit, and a medical device having distal and proximal ends;
a controller, the controller being connected to the medical device at a connection point on
the proximal end of the medical device;
a first cooling system directing coolant from the coolant supply to the medical device
along a coolant supply line through the connection point;
a second cooling system chilling the coolant within a portion of the coolant supply line
upstream of the connection point; and
wherein the second cooling system is disposed in a system component external to the
coolant supply unit.

Claim 26. (New) The medical cooling system of claim 25,
wherein the second cooling system includes an enclosure having a fluid inlet and a fluid
outlet, the enclosure defining a fluid path from the inlet to the outlet, and the enclosure envelops
the portion of the coolant supply line.

Claim 27. (New) The medical cooling system of claim 25,
wherein the second cooling system includes a Peltier cooler.

Claim 28. (New) The medical cooling system of claim 25,
wherein the system component is a connection box disposed along the coolant supply line
upstream of the connection point.

Claim 29. (New) The medical cooling system of claim 28,
wherein the second cooling system includes a Peltier cooler.

Claim 30. (New) The medical cooling system of claim 28,
wherein the connection box is an ECG connection box.

Claim 31. (New) The medical cooling system of claim 25,
wherein the system component is attached to an external surface of the coolant supply
unit.

Claim 32. (New) The medical cooling system of claim 31,
wherein the second cooling system includes a Peltier cooler.

Claim 33. (New) The medical cooling system of claim 25,
wherein the controller is disposed in the coolant supply unit.

Claim 34. (New) A medical cooling system, comprising:
a medical device having distal and proximal end portions;
a console having
 a housing,
 a coolant supply, and
 a controller,
one or more connecting lines coupling the console with the medical device, the one or
more connecting lines including a coolant supply line; and
a system component disposed at an intermediate point between the proximal end portion
of the medical device and the console, the system component including a subcooler disposed in
thermal communication with a portion of the coolant supply line.

Claim 35. (New) The medical cooling system of claim 34,
wherein the subcooler includes a Peltier cooler.

Claim 36. (New) The medical cooling system of claim 34,
wherein the system component is a connection box disposed around the coolant supply
line.

Claim 37. (New) The medical cooling system of claim 36,
wherein the connection box is an ECG connection box.

Claim 38. (New) The medical cooling system of claim 34,
wherein the system component is attached to an external surface of the housing of the
console.

Claim 39. (New) A medical cooling system, comprising:
a coolant supply;
a medical device having proximal and distal end portions, and having
a coolant inlet line from the proximal end portion to the distal end portion, and
a coolant return line from the distal end portion to the proximal end portion,
a coolant supply line between the coolant supply and the coolant inlet line;
a coolant recovery line between a source of vacuum and the coolant return line, the
coolant supply line, coolant inlet line, coolant return line, and the coolant recovery line defining
a first flow pathway from the coolant supply to the source of vacuum;
a vent line coupled to and disposed between the coolant supply line and the coolant
recovery line, a proximal portion of the coolant supply line, the vent line, and a distal portion of
the coolant recovery line defining a second flow pathway from the coolant supply to the source
of vacuum.

Claim 40. (New) The medical cooling system of Claim 39,
wherein the second flow pathway is external to the medical device.

Claim 41. (New) The medical cooling system of Claim 39,
wherein the vent line includes a vent valve.

Claim 42. (New) The medical cooling system of Claim 39, further comprising:
a scavenging tank coupled to the source of vacuum, the medical cooling system being
substantially open-loop.

Claim 43. (New) The medical cooling system of Claim 39, further comprising:
a compressor coupled to the source of vacuum and to the coolant supply, the medical cooling system being substantially closed-loop.

Claim 44. (New) A medical cooling system, comprising:
a coolant supply;
a medical device having proximal and distal end portions, and having
a coolant inlet line from the proximal end portion to the distal end portion, and
a coolant return line from the distal end portion to the proximal end portion,
a coolant supply line between the coolant supply and the coolant inlet line;
a coolant recovery line between a source of vacuum and the coolant return line, the
coolant supply line, coolant inlet line, coolant return line, and the coolant recovery line defining
a first flow pathway from the coolant supply to the source of vacuum,
wherein the coolant recovery line includes a pressure indicator.

Claim 45. (New) The medical cooling system of claim 44, further comprising:
a control console coupled to the pressure indicator to control the flow of coolant in the
first flow pathway.

Claim 46. (New) The medical cooling system of claim 45,
wherein the pressure indicator is a process control element coupled to a microprocessor
in the control console.

Claim 47. (New) The medical cooling system of claim 46,
wherein the pressure indicator is a safety monitoring element preventing an increase in
the pressure of the coolant in the coolant return line.